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OTHER MATTERS OF INTEREST

Developing emergency medical dispatch systems in Africa – Recommendations of the African Federation for Emergency Medicine/International Academies of Emergency Dispatch Working Group

Développement des systèmes de répartition d'urgence médicale en Afrique, selon les recommandations de la Fédération africaine de médecine d'urgence/Académies internationales du Groupe de travail de répartition d'urgence

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Emergency medical dispatch (EMD) systems are a crucial component of effective Emergency Medical Services (EMS) systems. They provide a means of public access to emergency care information and out-of-hospital emergency care resources and expertise. EMD systems also link various components of EMS, thereby improving efficiency and performance. As EMS systems are rapidly developing across many parts of Africa, EMD systems which are context appropriate are in great need, but are mostly absent despite the wide availability of telecommunications technology.

To facilitate the development of EMD systems appropriate for the African setting, the African Federation for Emergency Medicine (AFEM) and the International Academies of Emergency Dispatch (IAED) convened a working group in November 2014 to provide conceptual, technical, and innovative recommendations for contextually appropriate EMD systems for African settings. It is hoped that these recommendations will augment efficiency, effectiveness, and standardisation within and among African EMD systems, thereby improving health outcomes for sufferers of acute illness or injury.

Les systèmes de Répartition médicale d'urgence (RMU) représentent une composante cruciale des systèmes efficaces d'Aide médicale urgente (SAMU). Ils fournissent un moyen d'accès public à l'information sur les soins d'urgence et aux ressources et expertise en soins d'urgence hors de l'hôpital. Les systèmes de RMU font également le lien entre divers composants de l'AMU, améliorant ainsi l'efficacité et la performance. Alors que les sytèmes d'AMU se développent rapidement dans de nombreuses régions de l'Afrique, il existe un grand besoin de systèmes de RMU adaptés au contexte, souvent absents malgré la grande disponibilité des technologies de télécom munications.

Pour faciliter le développement de systèmes de RMU appropriés au contexte africain, la Fédération africaine de médecine d'urgence (AFEM, African Federation for Emergency Medicine) et les Académies internationales de répartition d'urgence (IAED, International Academies of Emergency Dispatch) ont convoqué un groupe de travail en novembre 2014 pour fournir des recommandations conceptuelles, techniques et innovantes aux systèmes de RMU adaptés au contexte africain. Il est à espérer que ces recommandations augmenteront l'efficacité, l'efficience et la normalisation au sein et entre les systèmes de RMU africains, améliorant ainsi les résultats en termes de santé pour les personnes souffrant de maladie aiguë ou de blessures.

African relevance

- Emergency Medical Dispatch (EMD) systems are a critical component of, and point of public access into, emergency care systems.

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- EMD can and should be carefully integrated into African settings so that they are locally-appropriate, sustainable, efficacious, and innovative.
- EMD systems can be economically and efficiently configured to utilise centralisation of call-taking and decentralisation of dispatching.
- Call-taking and call-processing are best accomplished when rehearsed, pre-determined, standardised, algorithm-based processes are used.

Introduction

Africa shares a disproportionately large burden of the world's morbidity and mortality, a significant proportion of which is attributed to acute illnesses and injuries.[1–3] The Disease Control Priorities project estimates that up to 45% of mortality and 36% of disability could be averted by effective emergency care systems.[4] Such systems function on a continuum, in which access and care occur in an uninterrupted, coordinated sequence (Fig. 1).[4–6]

The first four phases occur in the out-of-hospital setting.[5] Improved health outcomes may be achieved by strengthening each individual phase of care, and seamlessly integrating all phases.[1,6,7]

Most high income settings have Emergency Medical Services (EMS) systems in place; this is not the case in Africa, where such formalised systems are relatively rare and comparatively immature in their development.[8,9] Emergency medical dispatch (EMD) systems are a foundational, key component of EMS systems and play a critical role in strengthening the first four phases of the emergency care continuum.[6] EMD systems can provide populations with continuous, timely, and reliable telephone-based access to emergency care and information. Additionally, EMD systems can be innovatively configured to provide efficient, economical means of public health assistance, such as telephone advice for non-acute conditions and information on local healthcare resources.[10]

According to the International Telecommunication Union, there are ten times as many cellular phones as landlines in sub-Saharan Africa, and 60 percent of the population have mobile phone coverage, growing at a rate of about 10 percent per year from 2002 to 2007. Given the extensive coverage and increasing penetration of cellular phone technology within Africa, and the existence of telecommunication infrastructure,[11] EMD systems that are well-integrated, sustainable, culturally appropriate, comparatively low-cost, and tailored to the local burden of disease are theoretically implementable.[5] Further, the rapid expansion of technological solutions and the proliferation of 'cloud' based services adds a further dimension to the large scale impact that investment in technology could have – not just within a country, but potentially across regions. This may be even more marked in low resource areas where any investment towards greater efficiency and improved resource allocation is accompanied by significant improvements across the service platform.

Despite this significantly beneficial potential, a 2014 survey of African EMS officials and experts indicated that, while most had public access numbers, they did not utilise formalised EMD processes or systems.[12] In response, the African Federation for Emergency Medicine (AFEM) and the International Academies of Emergency Dispatch (IAED), recognising the potential beneficial impact on public health that development of African EMD systems may achieve, convened a joint meeting of individuals with expertise relevant to the development of EMD. The goal of this African EMD working group was to facilitate EMD development which is context-appropriate for the African setting, and had the following objectives:

1. To formulate and document the envisioned purposes, roles, and attributes of African EMD systems.
2. To identify priorities in the management of illness and injury conditions and complaints received by EMD systems in Africa.
3. To describe optional configurations and models of EMD for implementation in African settings.

Process

Twenty individuals with expertise in African emergency and trauma care, EMS, and emergency communication participated, constituting the African EMD working group. In addition to the US based IAED personnel, they represented 10 countries: Botswana, Cameroon, Ethiopia, Ghana, Kenya, Malawi, South Africa, Tanzania, Uganda, and Zambia. The two-day meeting was convened during the November 2014 African Conference on Emergency Medicine, in Addis Ababa, Ethiopia.

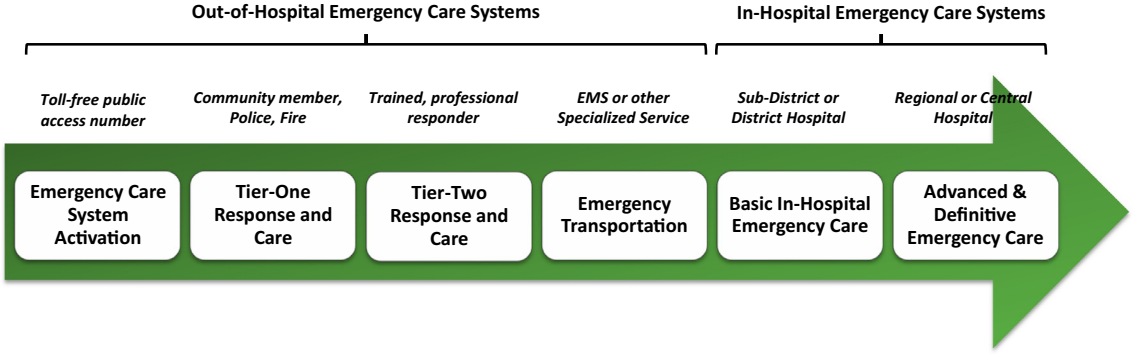

Figure 1 The emergency care continuum.

Using a consensus-by-majority process, the working group reviewed pertinent literature, conducted moderated deliberations, and reached consensus on topics within each of the three above-stated objectives. The working group unanimously agreed that all outputs from this initial meeting should be disseminated as practical recommendations to inform EMD development in Africa, and not as policy or standards given the relative lack of robust empiric data. We report on the outputs here.

Findings and recommendations

All of the findings and recommendations are directed at EMD systems in the African context.

The purpose, role, and attributes of EMD systems

EMD describes a system of communication designed to reliably allow the public to access available emergency medical resources (i.e. prehospital care and transportation, which are locally defined). The services provided by an EMD system must be *timely, safe, locally-appropriate*, and *reliable* – attributes endorsed by experts at the 2013 AFEM Out-of-Hospital Emergency Care Consensus Conference.[5]

The term *"dispatch"* specifically describes the process of activating and sending resources to the scene which, in Africa, may include community first-responders, participating taxis or mini-buses, fire services, law enforcement, or ambulances if available.

Further, given the large regional burden of disease associated with delayed and inappropriate transfer of patients from lesser to more specialised healthcare facilities, African EMD systems must also be tailored to service healthcare providers as utilisers of EMD services. The working group's recommendations are summarised below in Box 1.

Box 1. Working group's recommendations

- Each country has one guaranteed, free, public access telephone number that is government approved, and dedicated for emergency medical care access within a region or country.
- All local cellular telephone operators provide their customers with telephone access to the public access emergency number at no cost.
- All African cellular telephone companies provide services that facilitate automatic number identification and automatic location identification of callers to EMD, at no cost to customers.
- The public be educated on the appropriate indications for, mechanisms of access to, and reasonable expectations from accessing the emergency medical number.
  - This information must be effectively disseminated to the public as early as possible in the development of an EMD system, to minimise misuse, prevent misperceptions, and safeguard valuable emergency care resources.
- A communication centre be created to fulfill the role and mission of providing EMD.
  - Public, private, or public-private enterprises should be determined locally, insofar as other critical characteristics are preserved. Leveraging existing telecommunications infrastructure and personnel, e.g. cellular industry call centres and public safety answering points, may be practical and offer rapid solutions in resource-constrained settings.
- Given the paucity of empiric EMD data from African settings, systems developers and leaders of emerging African EMD systems reference existing international models and standards to guide EMD system development (e.g. IAED).

Management of injury and illness conditions and complaints by EMD systems

The working group's view on the role of EMD systems in managing illness and injury complaints of patients is: *To efficiently gather the right caller information, precisely and accurately organise and classify it in order to send the right resources, in the right mode, staffed by the right personnel, supported by the right information, to the right patient, while providing the caller with the right instructions, until responders arrive on-scene*.

To assist emerging EMD systems anticipate which complaints and conditions they are likely to receive, the working group recommends that EMD system leaders consider developing their EMD systems around the following high-volume, high morbidity and mortality events, acute conditions and complaints:

1. Inter-facility (inter-hospital) transfers.
2. Obstetric/maternal emergencies.
3. Trauma (non-road traffic injury).
4. Trauma (road traffic injury).
5. Respiratory emergencies (e.g. difficulty breathing).
6. Cardiovascular complaints (e.g. chest pain).
7. Gastrointestinal complaints (e.g. abdominal pain).
8. Neurologic complaints (e.g. stroke-like symptoms).
9. Altered mental status.
10. Neonatal emergencies.

Other conditions and complaints that constitute a disproportionately large local or regional burden of disease should be considered for addition to this list, based on local expert consensus.

The EMD systems' fundamental responsibility is to mitigate adverse patient outcomes by adhering to the following principles in the most efficient, safe, standardised, and culturally-appropriate manner: (i) identifying the patient's *location and identity* such that responders can be successfully dispatched to the scene, (ii) *process the call* to ascertain the presence of any life- or limb-threatening issues and differentiate high acuity from low acuity calls that might be suitable for alternative responses, (iii) provide *telephone-based instructions* to the caller to assist with basic early patient care prior to responders arriving on scene, and (iv) where possible, *maintain*

a constant level of telephone based care and contact, from the time of call receipt until responders arrive on scene (with limited resources and long response times, it may not be feasible to maintain this level of contact; for lower acuity conditions, it may not be necessary).

The working group acknowledges that the operationalisation and level of sophistication of these four principles will by necessity vary regionally or locally as a result of sociocultural, environmental, geographic, and public health related factors. However, tight adherence to the four principles stated above, regardless of the system's configuration and operation, is strongly recommended.

Additionally, the level and type of response to each category of acuity and condition has to be locally determined and appropriate (e.g. in one setting, telephone-based advice may be the only assistance available, while in another setting, an ambulance may be dispatched for the same complaint or condition). Each response mode is the most appropriate response for that setting at that time.

The working group strongly urges early standardisation within and between EMD systems. This applies to operational processes, questions asked of callers, patient care instructions, data collection, and metrics measured. Standardisation will enable efficiencies of scale, realised in the sharing of resources, comparisons among EMD systems, and integrating functions on a regional basis.

Given the rich ethnic, cultural, and linguistic variety in African settings, the working group encourages call-takers in communication centres, at the minimum, to be fluent in dominant local language(s), but to preferably be multilingual or have ready access to translation services. Cultural sensitisation training will be important for all call-takers. If the call-taker is unable to communicate with a caller, due to language or communication barriers, a pre-determined, local, standard operating procedure should be in place for processing such a call, then dispatching the most appropriate resources, if any, to the scene.

Most local healthcare systems are severely resource-constrained, yet face a large burden of disease. EMD systems will need to pre-determine which conditions or complaints assume priority e.g. neonatal or obstetric emergencies may supersede other call-types in settings that experience a disproportionately large neonatal or maternal death rate, thereby justifying this decision. Such decisions must be medically, ethically, socially, and politically considered with local stakeholders.

Configuration and models of EMD systems

The functional model of an EMD system is schematically presented in Fig. 2 and emphasises three procedural components: inbound communication (i.e. information that feeds into the EMD system), outbound communication (i.e. information generated from the EMD system), and incident management with quality oversight.

Acknowledging that EMD systems develop gradually, the working group recommends that communication centres operating mature EMD systems utilise a formal call processing and dispatching programme that includes the following procedural components:

- *Scripted questions*, directed to the callers, consisting of the following minimum components:
  - Patient location
  - A call back telephone number (in case the connection is disrupted)
  - Assessment of illness symptoms (and causative mechanism if an injury)
  - Patient condition
- *Scripted instructions*, directed to callers, that address scene safety, patient resuscitation from life threats, and stabilisation of emergency conditions.
- *Supervision* of call-processing and dispatch, via continuous quality improvement programmes and medical oversight, including leaders of emergency medical operations, to establish and maintain appropriate local, regional or national standards of medical care.

The working group endorsed a structural model depicting EMD geographic organisation (Fig. 3).

While call-taking and dispatch may be physically co-located within one communication centre, centralisation of call-taking and de-centralisation of dispatching is recommended. Call-processing, insofar as call-takers are technically and culturally proficient, does not require specific local expertise, while dispatching is significantly enhanced by the local knowledge of events, geography, and resources.

Centralising call-taking and call-processing achieves economies of scale through efficiencies in personnel recruitment and training, equipment procurement and maintenance, quality improvement processing, and responsiveness to changes in call-taking policies and procedures; these may prove advantageous in resource-constrained settings. Additional efficiency, stability and resiliency may be achieved in multi-agency EMD systems e.g. communication centres jointly operated through partnership between medical, public safety, fire, and communication agencies.

EMD systems must accommodate the unique operations, communications, and resources needed to conduct inter-facility transfers of medically complex and potentially unstable patients. In some low-resource systems with a large demand for inter-facility transfers, special personnel and procedures may be dedicated to manage such calls.

Provisions should be made to collect and store data gathered through call-taking, call-processing, and dispatch. Storage in simple electronic databases, e.g. in Microsoft Excel or Microsoft Access, will facilitate important EMD quality assurance, improvement, and research activities.

The working group has provided several detailed recommendations regarding information and sequences which may be considered in the programmatic organisation of EMD systems (see Appendix A, data supplement).

The role of technology in EMD call-taking is to support the logistical burden placed on call-takers (e.g. documenting, storing, and transferring caller and patient information). Technology cannot replace excellent training of call-takers in basic communications.

Regarding the qualifications of EMD call-takers, there is presently no evidence that a trained prehospital provider, nurse, or doctor is more effective in a nonvisual environment. The working group recommends local experts weigh the pros

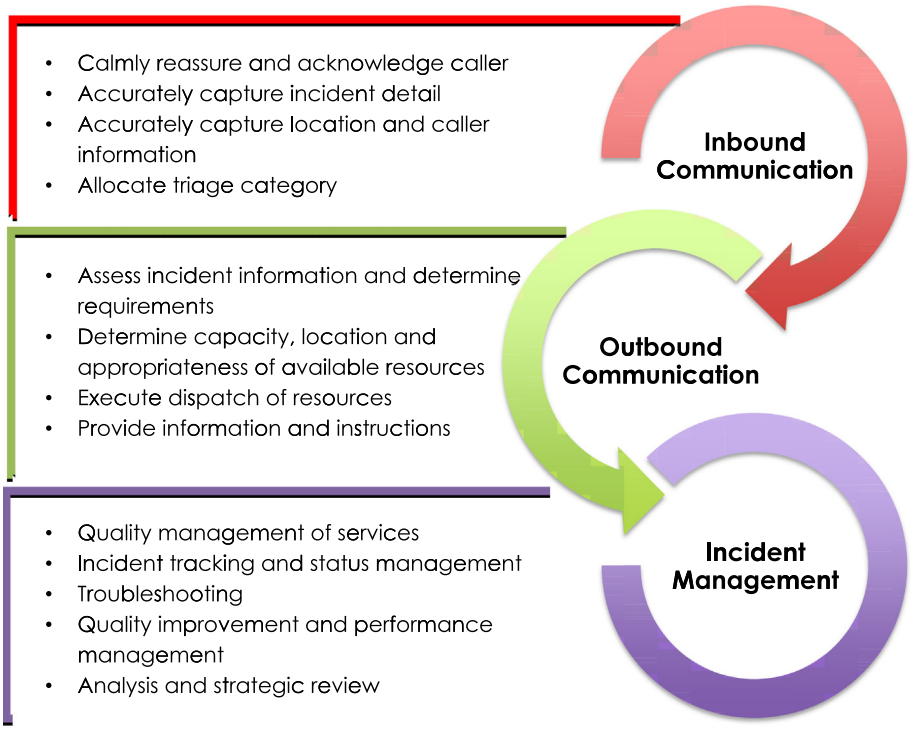

Figure 2 Recommended core functions of EMD systems.

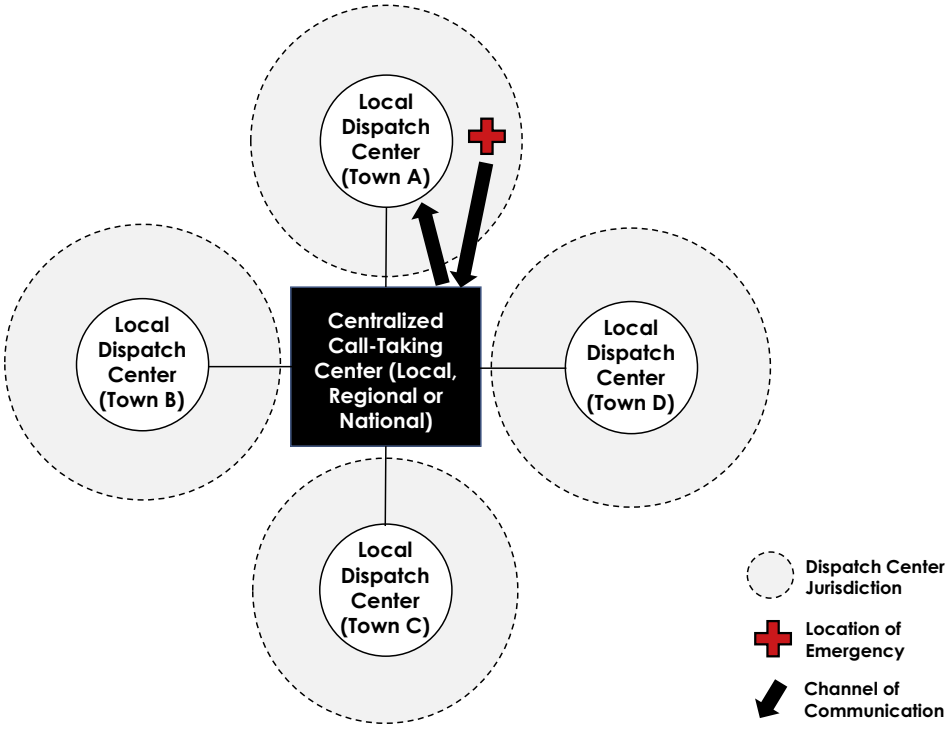

Figure 3 De-centralised model of EMD.

and cons of using laypersons versus prehospital trained personnel as call-takers. A layperson, insofar as they are locally qualified, credentialed and authorised, may be the most appropriate call-taker in settings where emergency medical resources are available and often respond to patient scenes. A trained prehospital provider may be more suitable in settings in which there may be no resources available, or lengthy response times, thereby able to offer more medical advice prior to resource scene arrival. Regardless of the personnel performing call-taking and call-processing, what is most important is

accurately following scripted instructions.[13,14] The working group's proposals for consideration in strategising for innovation and efficiency within EMD systems is described in Box 2.

Box 2. The working group proposes the following concepts for consideration in strategizing for innovation and efficiency within EMD systems

- Consider partnership with cell phone companies, which may hire staff with expertise in telephone communication, to perform initial EMD call-taking. Ambulance companies can be locally integrated to perform dispatching and scene responses. This must be closely integrated with EMD medical direction, quality improvement, and supervision.
- Ideally, all cell phones should be registered such that callers' numbers and identities can be automatically identified by EMD personnel (i.e. "automatic number/name identification"). The addition of "automatic location identification" services is also desired, where practical.
- "Corrupt," "prank," or inappropriate calls are a global problem. These should be anticipated and proactive local strategies designed to minimise their disruption. In some settings, automated messages, screening process, and public sensitisation have proved effective strategies.
- Consider functionally dividing the communication centre to handle specialised tasks e.g. inter-facility transfers, critical care responses, or aero-medical responses.
- Consider making provisions to adapt the communications centre into an incident command centre during local/regional disasters. This requires detailed preplanning and multi-agency simulation drills.
- Consider utilising the communications centre to centrally coordinate information about the bed status of healthcare facilities (e.g. diversion and occupancy status) and local healthcare events (e.g. emerging infectious diseases).

Future directions

The working group proposed the preceding recommendations (Box 2) to purposefully guide emerging EMD systems. As such systems are established, there will be a need for the development of evidence-based, expert-endorsed standards, including a set of critical components and critical functions. We hope there will be rapid development of low-cost, low-tech platforms that allow the propagation of EMD systems (e.g. independent from electricity, and paper-based algorithms to aid call-processing). Given the paucity of empiric regional EMD data, more research will be critical to determine the impact, safety, effectiveness, and sustainability of African EMD systems.

Conclusion

AFEM/IAED hosted a successful working group which believes that EMD systems are important and practical mechanisms for public and healthcare provider access to emergency care and transport in Africa. We have presented models that outline the configuration, structure, and function of EMD systems appropriate for integration into African healthcare systems. Given resource constraints, considerations and opportunities for innovation and efficiency during EMD system development have also been suggested. Well-conceived and developed EMD systems, appropriately tailored to African populations, may prove to be an effective, efficient intervention to help decrease the impact of the burden of acute disease.

Conflicts of interest

We, the authors, declare the following interests: N.M., S.V., C.S., L.W. are unpaid members of the AFEM Out-of-Hospital Emergency Care Committee. J.O. and R.M. are employed by the International Academies of Emergency Dispatch and Priority Dispatch Corporation, respectively. L.W. is an editor of this journal. All other authors declare no conflict of interest.

Author contributions

All authors participated in the November 2014 AFEM/IAED EMD working group at the AFEM conference, Chaired by N.M. Authors N.M., S.D., L.W. and C.S. drafted the original manuscript. All authors contributed to the editing, revision and approval of the final manuscript.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.afjem.2015.06.005.

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